STATE OF NEW MEXICO
BEFORE THE WATER QUALITY CONTROL COMMISSION

In the Matter of:	)	
PROPOSED AMENDMENT TO 20.6.2 NMAC (Dairy Rules)	)	**No.: WQCC 09-13 (R)**
New Mexico Environment Department, Petitioner.	)	

WRITTEN TESTIMONY OF BART FARIS

My name is Bart Faris, and I am an environmental scientist with the Ground Water Quality Bureau of the New Mexico Environment Department ("NMED" or "Department"). I am presenting this written testimony on behalf of the Department in support of its petition to the New Mexico Water Quality Control Commission ("Commission") to amend the Ground and Surface Water Protection Regulations, 20.6.2 NMAC to include a new Part, 20.6.6 NMAC. In addition to the testimony below, I have also provided testimony addressing various sections as set forth in NMED Attachment 8.

I. BACKGROUND AND EXPERIENCE

I have a B.S. in Soil and Water Science from the University of Arizona, 1983. I have more that 25 years experience in water resources, hydrology, environmental resource management and restoration, natural resources and community development. My resume is attached to the Department's Notice of Intent to File Technical Testimony as NMED NOI Exhibit C.

II. INTRODUCTION

The purpose of my testimony is to describe the groundwater contamination that exists at various dairies in New Mexico which are subject to an Abatement Plan (AP). This testimony also demonstrates the complexity of abatement procedures, which lead to high costs and considerable length of time to achieve abatement for the dairy or landowner. NMED has required Abatement Plans for 50 dairies throughout New Mexico (NMED Exhibit BF-1) because ground water monitoring through Discharge Plans (DP) has shown contamination at these dairies. Below, I describe four dairies which are examples of the size and scope of groundwater contamination found at diaries in New Mexico. The contaminants include nitrate as nitrogen (nitrate), total dissolved solids (TDS), sulfate, and chloride. The 50 dairies are at various phase of abatement, but the majority are pursuing plume definition under a Stage 1 AP. A few dairies have completed their Stage 1 AP activities and are in the process of implementing Stage 2 abatement. None of the 50 dairies have completed Stage 2 implementation to date. The following dairy examples show the estimated volume of contaminant plumes. Porosity was determined by the major lithologic unit encountered in the screened interval, a 20 foot depth of contamination was used if not measured in on-site vertical definition monitoring wells, and no sorption or retardation is attributed to any of the contaminants.

III. Former Valley Gold North Dairy (Prices Dairy Bernalillo)

This former dairy is located at 618 NM Highway 528 in Bernalillo and operated from the late 1960's until 1998 when the dairy ceased operations and all cattle and manure were removed. Over the course of its existence, this dairy had 2 unlined (manure) and 1 clay lined lagoon. Discharge Plan DP-47 was approved in 1987 and a corrective action plan was required under the DP in 1997. In 2002 NMED approved removal of the former land application area from the DP.

In 2005, NMED required that once a site characterization report was submitted, the DP would be terminated and further ground water investigation and remediation would proceed under AP regulations. NMED approved the characterization report as completion of Stage 1 AP activities and required the submittal of a Stage 2 AP proposal in 2006. The proposal showed that the preferred abatement option would be the pump and discharge of contaminated ground water to the Town of Bernalillo's wastewater treatment plant. Following the public notice, an entity requested a hearing on the proposal primarily due to the concern that the treatment plant could not effectively treat the discharges, which lead to a suspension in Stage 2 activities and further site characterization. Additional site characterization revealed that there were two separate aquifers underlying the former dairy; the Valley Fill Aquifer and the Upper Santa Fe Aquifer. To date, there are 14 monitoring wells installed to define plume conditions, with 8 wells in the Valley Fill Aquifer and 6 in the Upper Santa Fe Aquifer. Ground water is at a depth of approximately 35 feet in the Valley Fill Aquifer and 85 feet in the Upper Santa Fe Aquifer. Ground water monitoring results from December 2009 show that the maximum concentrations for nitrate, TDS, and chloride were 140 milligrams per liter (mg/L), 3,190 mg/L, and 420 mg/L, respectively found within the Valley Fill Aquifer. Ground water sulfate results in the Upper Santa Fe aquifer ranged from 38.7 to 1,010 mg/L. Maximum nitrate concentrations in the Upper Santa Fe Aquifer were 35 mg/L. NMED Exhibit BF-2 shows nitrate concentrations in the Valley Fill Aquifer. All other wells are in the Upper Santa Fe Aquifer.

Plume volume estimates are provided for nitrate, TDS, and chloride above standards. The estimate of plume volume is based on (area) (depth) (avg. porosity) (7.48 gals./cu. ft.). The following table provides assumptions used and calculated volumes:

	Valley Fill Aquifer		Upper Santa Fe Aquifer	
Porosity	0.30		0.35	
Vertical definition	20		10*	
Nitrate (plume area)	1.07712×10^8 gal (2,000 x 1,200ft)	330.55 ac.ft.	1.33518×10^8 gal (1,700 x 3,000ft)	409.75 ac.ft
TDS (plume area)	68,666,400 gal (1,800 x 850ft)	210.73 ac. ft.	1.1058×10^8 gal (1,600 x 2,640ft)	339.37 ac.ft.
Chloride (plume area)	3,456,000 gal (1,600 x 360ft)	10.61 ac.ft.	47,124,000 gal (2,500 x 840ft)	144.62 ac.ft.

*vertical depth assumption based on site lithology – no measured data from a vertical definition monitoring well

Table 1 - Former Valley Gold North Dairy Plume Volume Estimates

Please note that these contaminant plumes are comingled and the largest plume (nitrate) indicates the total estimated volume of contamination. Combining both aquifers shows an estimated total volume of contaminated ground water at 2.4123×10^8 gallons or 740.3 ac.ft.

IV. Cheyenne 1 and 3 Dairy

The site is located at 170 Cheyenne Road in Dexter, New Mexico. Wastewater has been discharged on-site to clay-lined and synthetically-lined impoundments and land application areas under Discharge Plan DP-677. The DP is under a renewal and modification that consists of combining both Cheyenne Dairy 1 and Cheyenne Dairy 3 under one Discharge Permit, increasing the discharge volume from 58,000 gallons per day to 180,000 gallons per day, increasing the land application area from 96 to 619 acres, and requiring abatement of ground water contamination. Corrective action to address ground water contamination was approved by NMED in 2004. Assessment activities have identified a shallow and deep aquifer. To date, there are 34 monitoring wells installed to define plume conditions, with 15 wells in the shallow aquifer and 19 in the deep aquifer. The dairy supplies bottle water to 3 adjacent domestic wells with contamination above standards. An additional domestic well owner declined bottled water from the dairy since he purchases his own for consumption. Ground water monitoring results from December 2009 show that the maximum concentrations for nitrate, TDS, and chloride were 100 mg/L, 3,440 mg/L, and 470 mg/L, respectively found within the shallow aquifer. Maximum nitrate concentrations in the

deep aquifer were 80 mg/L. Sulfate concentrations ranged from 410 mg/L to 1,500 mg/L. Ground water is at a depth of approximately 70 feet in the shallow aquifer and 107 feet in the deep aquifer. NMED Exhibits BF-3 and BF-4 show nitrate concentrations in the respective aquifers.

Plume volume estimates are provided for nitrate, TDS, and chloride above standards. The estimate of plume volume is based on (area) (depth) (avg. porosity) (7.48 gals./cu. ft.). The following table provides assumptions used and calculated volumes:

	Shallow Aquifer		Deep Aquifer	
Porosity	0.2		0.2	
Vertical definition	10		20*	
Nitrate (plume area)	86,169600 gal (2,400 x 2,400 ft)	264.44 ac.ft.	2.3936×10^8 gal (4,000 x 2,000 ft)	734.57 ac.ft
TDS (plume area)	1.00531×10^8 gal (2,400 x 2,800 ft)	308.52 ac. ft.	2.011×10^8 gal (2,800 x 2,400 ft)	617.04 ac.ft.
Chloride (plume area)	86,169600 gal (2,400 x 2,400 ft)	264.44 ac.ft.	5.7446×10^7 gal (1,600 x 1,200 ft)	176.29 ac.ft.

*vertical depth assumption based on site lithology – no measured data from a vertical definition monitoring well

Table 2 – Cheyenne 1 and 3 Dairy Plume Volume Estimates

Please note that these contaminant plumes are comingled and the largest plume (TDS in the shallow aquifer and nitrate in the deep aquifer) indicates the total estimated volume of contamination. Combining both aquifers shows an estimated total volume of contaminated ground water at 3.399×10^8 gallons or 1,043.09 ac.ft.

V. J&M Dairy

This dairy is located four miles north of Artesia within Section 20, Township 16 South, Range 26 East. Wastewater has been discharged to on-site lagoons and land application areas under Discharge Plan DP-765. The DP is under a renewal modification to discharge approximately 90,000 gallons per day to the lagoon and land application area via flood and sprinkler irrigation. Corrective action to address ground water contamination was approved by NMED in 2006.

Assessment activities have identified a shallow and deep aquifer. To date, there are 21 monitoring wells installed to define plume conditions with 8 wells in the shallow aquifer, 7 in the deep aquifer, and 5 showing mixed water levels. Ground water monitoring results from March 2009 show that the maximum concentrations for nitrate, TDS, and chloride were 200 mg/L, 4,700 mg/L, and 430 mg/L, respectively. Ground water is at a depth of approximately 35 feet in the shallow aquifer and 80 feet in the deep aquifer. The data indicate a connection between the two aquifers and mounding. NMED Exhibits BF-5 and BF-6 show nitrate concentrations in the respective aquifers.

Plume volume estimates are provided for nitrate, TDS, and chloride above standards. The estimate of plume volume is based on (area) (depth) (avg. porosity) (7.48 gals./cu. ft.). The following table provides assumptions used and calculated volumes:

	Shallow Aquifer		Deep Aquifer	
Porosity	0.35		0.25	
Vertical definition	10		20*	
Nitrate (plume area)	4.60771×10^8 gal (3,200 x 5,500 ft)	1,414.04 ac.ft.	6.485×10^8 gal (3,400 x 5,100 ft)	1,990.21 ac.ft
TDS (plume area)	5.5771×10^8 gal (5,600 x 3,800 ft)	1,711.54 ac. ft.	7.9587×10^8 gal (5,600 x 3,800 ft)	2,442.43 ac.ft.
Chloride (plume area)	1.4975×10^8 gal (2,200 x 2,600 ft)	459.56 ac.ft.	8.415×10^7 gal (2,500 x 900 ft)	258.25 ac.ft.

*vertical depth assumption based on site lithology – no measured data from a vertical definition monitoring well

Table 3 – J&M Dairy Plume Volume Estimates

Please note that these contaminant plumes are comingled and the largest plume (TDS) indicates the total estimated volume of contamination. Combining both aquifers shows an estimated total volume of contaminated ground water at 1.3536×10^9 gallons or 4,153.97 ac.ft.

VI. Sun Valley Dairy

The dairy is located at 181 Links Road in Berino, New Mexico and has discharged wastewater on-site to synthetically, clay, and manure-lined impoundments under the history of Discharge Plan DP-170. The DP is under a renewal and modification to discharge up to 35,000

gallons per day of wastewater from the milking parlor flows to a primary synthetically lined lagoon. Wastewater from the primary lagoon is then pumped to two additional synthetically lined lagoons for disposal by total evaporation. The modification consists of increasing the discharge volume from 26,000 to 35,000 gallons per day and replacing the 26-acre land application area used for wastewater disposal with a synthetically lined lagoon system designed for total evaporative disposal of wastewater. Corrective action to address ground water contamination was approved by NMED in 2005. To date, there are 21 monitoring wells installed to define plume conditions. Potentiometric data clearly shows a ground water mound as seen in NMED Exhibit BF-7. Ground water monitoring results from July 2009 show that the maximum concentrations for nitrate, TDS, and chloride were 138.6 mg/L, 2,685 mg/L, and 1,140 mg/L, respectively. A background well (MW-14) does have TDS and chloride concentrations above standards at 1,515 mg/L and 500 mg/L, respectively. Ground water is at depths ranging from 37 to 66 feet. NMED Exhibit BF-8 shows nitrate concentrations in the shallow aquifer.

Plume volume estimates are provided for nitrate, TDS, and chloride above standards. The estimate of plume volume is based on (area) (depth) (avg. porosity) (7.48 gals./cu. ft.). The following table provides assumptions used and calculated volumes:

	Shallow Aquifer	
Porosity	0.30	
Vertical definition	20*	
Nitrate (plume area)	6.3533×10^8 gal (4,530 x 3,125 ft)	1,949.76 ac.ft.
TDS** (plume area)	7.7044×10^8 gal (5,780 x 2,970 ft)	2,364.38 ac. ft.
Chloride** (plume area)	4.7124×10^8 gal (4,200 x 2,500 ft)	1,446.18 ac.ft.

*vertical depth assumption based on site lithology – no measured data from a vertical definition monitoring well
** plume volume estimates are based on the background above standards concentrations

Table 4 – Sun Valley Dairy Plume Volume Estimates

Please note that these contaminant plumes are comingled and the largest plume (TDS) indicates the total estimated volume of contamination.

The estimates of contaminant areas from 2 of the 4 dairy examples clearly show that groundwater contaminant plumes can and do extend beyond a mile in length. For comparison purposes, the Office of the State Engineer's Rules and Regulations Governing the Use of Public Underground Water for Household or Other Domestic Use 19.27.5.9.D NMAC allows 1.0 acre-feet of water use per year. The estimated volume of contaminated water from these 4 dairy examples would provide sufficient water to serve about 8,300 households for a whole year.

Not only have dairy facilities contaminated large volumes of ground water, as can be seen from these examples, the characterization of contamination can require numerous monitoring wells, and the abatement process can be time consuming, complex and costly.